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Smoking Patterns by Occupation and Duration of Employment

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Lifetime patterns of smoking and occupation based on personal interviews were examined among 3,627 white men and 1,200 white women who were randomly selected from ten areas in the United States during the period 1977–1978. These individuals participated in the control series of the National Bladder Cancer Study. We estimated, based on Axelson's method, the extent to which smoking habits for given occupational groups would confound the estimated relative risk for lung cancer for 62 occupations among men and 18 occupations among women. Among men, confounding by smoking resulted in a 30% or greater increased risk of lung cancer in only three occupational groups—namely, stationary engineers and power station operators (relative risk (RR) = 1.6), printers (RR = 1.3), and fishermen and sailors (RR = 1.3). A decrease in lung cancer risk of 0.8 or less due to smoking habits was observed among the clergy (RR = 0.5) and chemical workers (RR = 0.7). Among women, a 30% increase or greater in the risk of lung cancer based on smoking habits alone was found for food service workers (RR = 1.5), building managers and administrators (RR = 1.3), telephone and telegraph operators (RR = 1.3), and operatives (RR = 1.3). A risk ratio of 0.8 or less was observed for those women employed as farmers (RR = 0.5) and teachers (RR = 0.8). Smoking habits by duration of employment were also examined for 38 occupations among men. The largest increase in the risk of lung cancer based on the smoking habits among long-term workers was only 1.3 and was observed for those men employed 20 or more years as painters and as electricians. These findings suggest that the smoking patterns, in only a few occupational groups that we evaluated, confound estimates of the relative risk by more than 30%, and for most occupational groups under investigation in this study, confounding by smoking alone did not produce trends in relative risks by duration of employment.

Key words: cohort mortality studies, confounding, epidemiologic methods, industry, lung cancer, relative risk

INTRODUCTION

Previous surveys of smoking habits by occupation [Brackbill et al., 1988; Covey and Wynder, 1981; Stellman et al., 1988; Sterling and Weinkam, 1978, 1976;

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US DHHS, PHS, Office on Smoking and Health, 1985; Weinkam and Sterling, 1987] have provided data to help estimate the confounding effects of smoking in occupational cohort mortality studies, particularly of lung cancer. In these studies, however, occupation was typically defined as current or usual occupation. In the National Bladder Cancer Study [Hartge et al., 1984], lifetime occupational histories as well as smoking histories were collected from over 5,000 respondents randomly selected from ten areas of the United States. This detailed information on occupation provided us with the opportunity to examine smoking habits, based not only on ever and usual employment in an occupational category but also by duration of employment in order to identify occupational groups whose lung cancer risk may be confounded by smoking practices.

SUBJECTS AND METHODS

The study population consisted of an age- and sex-stratified sample of the general population in the metropolitan areas of Atlanta, Detroit, New Orleans, San Francisco, and Seattle, and in the states of Connecticut, Iowa, New Jersey, New Mexico, and Utah drawn during 1977–1978 and selected to serve as the control series for the National Bladder Cancer Study. A detailed description of the selection of these individuals has been given elsewhere [Hartge et al., 1984]. Since this study group was age-matched to the bladder cancer cases, the subjects tended to be older than a random sample of the general population. Persons aged 21–64 years were selected from households with telephones by random digit dialing. Individuals aged 65–84 years were randomly drawn from the Health Care Financing Administration's list of individuals over age 64 years in each study area. A total of 6,985 individuals aged 21–84 years were identified, 5,782 of whom were interviewed. The response rate was 83% among men and 81% among women. The median age was 67 years. The present analysis included 3,627 white males and 1,200 white females. Non-white males and females were excluded owing to small numbers, and 265 white males and 166 white females were excluded either because of insufficient information on smoking or occupation or because the respondent was never employed.

In-person interviews administered by trained personnel were conducted in the respondent's home. Information on occupation included the job title, the name and address of the employer, the year employment started and ended, and a description of duties for every job a person held for 6 months or longer since the age of 12 years. This information was then coded into occupational categories based on the 1970 Census of Population Alphabetical Index Industries and Occupations [U.S. Bureau of the Census, 1971]. Smoking prevalences for subjects "ever employed" in each occupational category as well as by duration of employment (<5 years, 5–19 years, and 20+ years) were computed. Occupations that had at least 50 males or 50 females employed were included in the analysis based on "ever employment." Occupations examined by duration of employment had to have at least 100 persons employed. The smoking histories contained information on usual amount smoked, duration of smoking, and current smoking status. For subjects ever employed in an occupation, we used the following smoking categories: never smoked, former smokers, currently smoked $\leq$1 pack/day, and currently smoked >1 pack/day. To examine smoking patterns by duration of employment, subjects were classified as never smoked, usually smoked $\leq$1 pack/day, and usually smoked >1 pack/day.

The method presented by Axelson was used to determine occupational groups whose smoking habits may confound the estimate of the rate ratio for lung cancer [Axelson, 1978; Axelson and Steenland, 1988]. We assumed a multiplicative model for the joint effect of a potential occupational exposure and smoking [Gail et al., 1988]. For this analysis the formula was expressed as

$$I = R_1 I_0 Ps_1 + R_2 I_0 Ps_2 + R_3 I_0 Ps_3 + I_0 (1 - Ps_1 - Ps_2 - Ps_3),$$

or

$$I/I_0 = R_1 Ps_1 + R_2 Ps_2 + R_3 Ps_3 + (1 - Ps_1 - Ps_2 - Ps_3)$$

where I = total incidence rate of lung cancer in the population, I_0 = incidence rate of lung cancer among nonsmokers, Ps_1 = proportion of former smokers in the population, Ps_2 = proportion of current moderate smokers, Ps_3 = proportion of current heavy smokers, and $R_1 = 5$, $R_2 = 10$, and $R_3 = 20$, the estimated relative risk of lung cancer among former smokers, moderate smokers, and heavy smokers, respectively [Kahn, 1966].

For a given occupational category, the estimated relative effect on lung cancer based on smoking habits alone, i.e., the confounding risk ratio, was computed by dividing the risk ratio of the occupational category (I/I_0 occupation) by the risk ratio of the reference population (I/I_0 reference). Thus, a confounding risk ratio of 1.3 implies that the observed 30% increase in the risk of lung cancer among workers in an occupational group is due to the smoking habits of the occupational group compared to the reference population and is not the result of any proposed occupational exposure. For the analysis of smoking patterns by duration of employment, the I/I_0 for a given duration category in an occupational group was divided by the I/I_0 of the reference population.

Separate analyses were performed on men and women. The reference population for the analyses on men consisted of all the male occupations combined, i.e., the total sample of men in the study (N = 3,627). Similarly, the reference population for women consisted of the total sample of women in the study (N = 1,200). In the male reference population, 31% never smoked, 42% were former smokers, 16% currently smoked up to and including one pack per day, and 11% currently smoked more than one pack per day. Among all women in the study, 64% never smoked, 14% were former smokers, 16% currently smoked up to and including one pack per day, and 6% currently smoked more than one pack per day.

Smoking prevalences were adjusted for age (<55, 55–64, 64–74, 75+ years) by the direct method using the age distribution of the reference population as the standard. Among men, 17% were between the ages of 21 and 54 years, 27% were between ages 55 and 64, 33% were between ages 65 and 74, and 23% were between ages 75 and 84. Among women, the corresponding percentages for each age group were 19%, 22%, 34%, and 25%, respectively. The effect of potential confounding by geographic location of study subjects was assessed, and adjustment proved unnecessary.

RESULTS

In Table I, smoking habits for subjects usually employed as white collar workers (professionals, technical, managerial, sales, and clerical workers), blue collar workers, and farmers are shown. Among men, a higher proportion of farmers and white collar workers are nonsmokers, 40% and 36%, respectively, than blue collar workers

TABLE I. Smoking Patterns by Major Occupational Titles

Group	Nos. employed[a]	% nonsmokers[b]	% former smokers	Current % ≤1 pack/day	Current % >1 pack/day
White males					
White collar	(1,605)	36	41	11	12
Blue collar	(1,700)	25	43	20	12
Craftsmen	(796)	25	45	18	12
Operatives and laborers	(716)	25	40	22	13
Service workers	(188)	24	43	22	11
Farmers	(322)	40	37	16	7
White females					
White collar	(698)	62	16	16	6
Blue collar	(481)	67	10	16	7
Craftsmen	(28)	76	4	7	13
Operatives and laborers	(247)	65	11	18	6
Service workers	(206)	68	10	15	7
Farmers	(21)	75	16	9	—

[a]Nos. employed are based on usual employment in each category.
[b]All percentages are directly adjusted for age.

(25%). A higher proportion of blue collar workers (32%) than white collar workers (23%) currently smoked, although the proportion of heavy smokers was the same for the two groups (12%). The proportion of former smokers also did not differ in the two groups. Little variation in smoking habits was found for three subcategories under blue collar workers—craftsmen, operatives and laborers, and service workers. There were slightly fewer nonsmokers and slightly more former smokers among female white collar workers versus blue collar workers. The proportion who currently smoked, however, was quite similar for these two groups. The small number of women employed as farmers precluded any comparisons with this group.

We also examined smoking habits for those occupations in which at least 50 persons were ever employed. For men, 62 occupations met this criterion, 44 of which were blue collar groups. A list of these occupations can be found in Appendix A. The percentage of nonsmokers ranged from 13% among stationary engineers and power station operators to 59% among clergymen. For most of these occupational groups, however, the proportion of nonsmokers was quite similar to the reference group. Table II presents smoking prevalences and the corresponding confounding risk ratios for the 21 occupations in which the confounding risk ratios were either $\geq 10\%$ or $\leq 10\%$ of the male reference population. The largest risk ratio for lung cancer based on smoking habits was observed for stationary engineers and power station operators (RR = 1.6). The smoking patterns of only two other occupational groups resulted in a confounding risk ratio of 1.3 or greater, namely, printers (RR = 1.3) and fishermen and sailors (RR = 1.3). A confounding risk ratio of 0.8 or less was observed for the clergy (RR = 0.5) and chemical workers (RR = 0.7).

We also analyzed smoking patterns by occupation for categories in which at least 50 women were ever employed. Of the 18 occupations we examined, 10 were in blue collar categories. The prevalence of nonsmokers ranged from 53% among building managers to 82% among farmers. A list of these 18 occupations appears in

TABLE II. Smoking Patterns and Confounding Risk Ratios for Lung Cancer by Occupational Title, White Males

Occupation title	Nos. employed[a]	% non-smokers[b]	% former smokers	Current % ≤1 pack/day	Current % >1 pack/day	Estimated confounding risk ratio[c]
Reference group (all occupations)	(3,627)	31	42	16	11	1.0
White collar occupations						
Airline pilots and flight attendants	(50)	27	49	6	18	1.1
Bank tellers and cashiers	(132)	30	43	8	19	1.1
Teachers, economists, mathematicians, psychologists, social scientists	(268)	36	46	9	9	0.9
Engineers	(226)	36	44	11	9	0.9
Architects and draftsmen	(97)	37	41	13	9	0.9
Clergymen	(53)	59	35	4	2	0.5
Blue collar occupations						
Stationary engineers and power station operators	(52)	13	40	17	30	1.6
Printers	(74)	21	42	19	18	1.3
Fishermen and sailors	(136)	21	42	19	18	1.3
Railroad workers	(67)	22	48	11	19	1.2
Electricians	(113)	22	44	19	15	1.2
Policemen, detectives, guards	(248)	21	46	19	14	1.2
Plumbers and pipefitters	(89)	22	46	19	13	1.1
Textile workers	(102)	26	38	23	13	1.1
Cooks, bakers, food counter workers	(196)	23	43	22	12	1.1
Welders, flame-cutters, solderers	(145)	25	38	26	11	1.1
Tailors and dressmakers	(59)	28	31	29	11	1.1
Garage workers and gas station attendants	(204)	24	47	15	14	1.1
Ore refining and foundry workers	(61)	27	40	20	13	1.1
Chemical workers	(87)	44	41	9	6	0.7

[a]Men employed in more than one occupation are included in each occupation in which they worked for 6 months or longer.

[b]All percentages are directly adjusted for age.

[c]Assumes no confounding by smoking for all occupations combined (reference population) and relative risk = 5 for former smokers, relative risk = 10 for current smokers ≤1 pack/day, and relative risk = 20 for current smokers > 1 pack/day.

Appendix B. Table III presents the smoking patterns and the confounding risk ratios for the 15 occupations in which the confounding risk ratios were either ≥10% or ≤10% of the reference population of women. Food service workers showed the largest confounding risk ratio for lung cancer (RR = 1.5). Smoking patterns among

TABLE III. Smoking Patterns and Confounding Risk Ratios for Lung Cancer by Occupational Title, White Females

Occupation title	Nos. employed[a]	% non smokers[b]	% former smokers	Current % ≤1 pack/day	Current % >1 pack/day	Estimated confounding risk ratio[c]
Reference group (all occupations)	(1,200)	64	14	16	6	1.0
White collar occupations						
Managers and administrators	(96)	53	19	18	10	1.3
Nurses, midwives, dieticians	(104)	56	16	19	9	1.2
Bank tellers and cashiers	(75)	60	15	17	8	1.1
Teachers, economists, mathematicians, psychologists, social scientists	(160)	70	15	12	3	0.8
Blue collar occupations						
Food service workers	(150)	50	14	24	12	1.5
Telephone and telegraph operators	(80)	56	10	26	8	1.3
Operatives, miscellaneous and not otherwise specified	(60)	58	12	20	10	1.3
Manufacturing workers not elsewhere specified	(148)	59	10	22	9	1.2
Metal machinery workers	(119)	58	19	14	9	1.1
Storekeepers and stock clerks	(95)	59	14	20	7	1.1
Clerical workers	(440)	59	16	18	7	1.1
Private household workers	(187)	74	8	12	6	0.9
Cleaners, housekeepers	(55)	64	20	12	4	0.9
Tailors and dressmakers	(114)	70	11	15	4	0.9
Farmers						
Farmers and laborers	(61)	82	11	6	1	0.5

[a]Women employed in more than one occupation are included in each occupation in which they worked for 6 months or longer.

[b]All percentages are directly adjusted for age.

[c]Assumes no confounding by smoking for all occupations combined (reference population) and relative risk = 5 for former smokers, relative risk = 10 for current smokers ≤1 pack/day, and relative risk = 20 for current smokers >1 pack/day.

women employed as building managers and administrators, telephone and telegraph operators, and operatives resulted in confounding risk ratios of 1.3. All of the remaining occupations had lower risk ratios, with smoking patterns among farmers (RR

= 0.5) and teachers (RR = 0.8) resulting in risk ratios of 0.8 or less. (Tables presenting smoking patterns for the 62 occupations among men and 18 occupations among women are available from the authors upon request).

To evaluate the extent to which smoking patterns of long-term workers may confound estimates of relative risks of lung cancer, we compared smoking habits by duration of employment for men in a given occupation to the smoking patterns of the male reference population. For this analysis, we examined the 37 occupational categories in which at least 100 men were ever employed. A list of these occupations is presented in Appendix C. Smoking habits were defined as never smoked, usually smoked ≤ 1 pack/day, and usually smoked >1 pack/day. For most of the occupations, confounding by smoking was slight or not apparent among long-term workers, and little trend in the confounding risk ratio with duration of employment was observed.

Table IV presents the smoking patterns as well as the corresponding confounding risk ratios for ten occupations of special interest. These are occupational categories in which previous cohort and surveillance studies have reported increases in lung cancer risk [Dubrow and Wegman, 1983]. The largest observed increase in the confounding risk ratio based on smoking habits of long-term workers was found for men who worked for 20 or more years as painters (RR = 1.3). Painters who had worked less than 20 years showed no difference in risk based on smoking habits when compared to the reference population. A very slight trend of increasing lung cancer risk based on smoking habits with increasing duration of employment was observed for garage workers and gas station attendants. Also, men who had worked more than 5 years as cooks had a slight elevation in lung cancer risk due to smoking compared to men who had worked less than 5 years in this occupation. Among the remaining 28 occupations, the largest observed confounding risk ratio among long-term workers was only 1.3 and was found for men who had worked 20 or more years as electricians. For this category, there also was no trend in risk by duration of employment due to smoking.

DISCUSSION

The data presented here are in general agreement with previous surveys of smoking prevalences among occupational groups, even though other studies covered slightly different time periods and defined occupational and smoking status in different ways. The finding that the general category of farmers was the group least likely to smoke was consistent with several reports in the literature [Brackbill et al., 1988; Covey and Wynder, 1981; Stellman et al., 1988; Sterling and Weinkam, 1978, 1976; US DHHS, PHS, Office on Smoking and Health, 1985; Weinkam and Sterling, 1987]. We also observed a higher percentage of current smokers among male blue collar workers (32%) than among male white collar workers (23%), and less variation between blue collar (23%) and white collar workers (22%) among women, which is comparable to data generated from the National Health Interview Survey (NHIS) for the period 1978–1980 and used in the 1985 U.S. Surgeon General's report [US DHHS, PHS, Office on Smoking and Health, 1985] as well as in other studies [Brackbill et al., 1988; Weinkam and Sterling, 1987]. Our percentages of current smokers, however, were somewhat lower than that obtained from the NHIS. A likely explanation of these slightly lower figures is that the NHIS was restricted to respondents 20 to 64 years of age [US DHHS, PHS, Office on Smoking and Health, 1985],

TABLE IV. Smoking Patterns in Percent by Duration of Employment and Confounding Risk Ratios for Lung Cancer, White Males*

	Duration of employment		
	< 5 years	5–19 years	20+ years
Auto workers (N = 134)			
% never	31[a]	22	27
% ≤1 pack/day	40	39	59
% >1 pack/day	29	39	14
Estimated confounding risk ratio[b]	1.0	1.2	0.9
Cooks, bakers, food counter workers (N = 193)			
% never	29	16	18
% ≤1 pack/day	40	47	44
% >1 pack/day	31	37	38
Estimated confounding risk ratio	1.1	1.2	1.2
Construction workers (N = 463)			
% never	26	28	25
% ≤1 pack/day	44	46	38
% >1 pack/day	30	26	37
Estimated confounding risk ratio	1.1	1.0	1.1
Drivers of motor vehicles (N = 779)			
% never	28	23	27
% ≤1 pack/day	42	41	41
% >1 pack/day	30	36	32
Estimated confounding risk ratio	1.1	1.2	1.1
Garage workers, gas station attendants (N = 200)			
% never	29	20	26
% ≤1 pack/day	42	55	32
% >1 pack/day	29	25	42
Estimated confounding risk ratio	1.1	1.1	1.2
Mechanics (N = 497)			
% never	31	26	24
% ≤1 pack/day	38	42	43
% >1 pack/day	31	32	33
Estimated confounding risk ratio	1.0	1.1	1.1
Metal machinery workers (N = 730)			
% never	24	28	25
% ≤1 pack/day	41	39	50
% >1 pack/day	35	33	25
Estimated confounding risk ratio	1.1	1.1	1.0

(*continued*)

TABLE IV. Smoking Patterns in Percent by Duration of Employment and Confounding Risk Ratios for Lung Cancer, White Males* (Continued)

	Duration of employment		
	< 5 years	5–19 years	20+ years
Metal fabrication workers (N = 378)			
% never	24	22	34
% ≤1 pack/day	46	40	40
% >1 pack/day	30	38	26
Estimated confounding risk ratio	1.1	1.2	1.0
Painters (N = 129)			
% never	28	23	12
% ≤1 pack/day	46	57	43
% >1 pack/day	26	20	45
Estimated confounding risk ratio	1.0	1.0	1.3
Welders, flame-cutters, solderers (N = 138)			
% never	30	20	25
% ≤1 pack/day	38	53	59
% >1 pack/day	32	27	16
Estimated confounding risk ratio	1.1	1.1	0.9

*Numbers of respondents are given in parentheses.
[a]All percentages are directly adjusted for age.
[b]In the reference population, 31% never smoked, 41% smoked ≤1 pack/day and 28% smoked >1 pack/day; assumes no confounding by smoking for all occupations combined (reference population) and relative risk = 10 for usually smoked ≤1 pack/day and relative risk = 20 for usually smoked >1 pack/day.

while our study population was older, as it was selected to match the age distribution of bladder cancer patients. The smoking patterns of this sample, however, better reflect the smoking patterns of older individuals subject to chronic diseases.

We also examined smoking habits by occupational titles for men and women and, as in other studies, found some differences in smoking prevalences among specific occupational groups [Brackbill et al., 1988; Covey and Wynder, 1981; Stellman et al., 1988; Sterling and Weinkam, 1978, 1976; US DHHS, PHS, Office on Smoking and Health, 1985; Weinkam and Sterling, 1987]. Based on the method presented by Axelson [Axelson, 1978; Axelson, and Steenland, 1988], we also attempted to identify occupational groups whose smoking habits could confound lung cancer risks observed in cohort mortality studies. We chose to evaluate the confounding effect of smoking on lung cancer risk because of the strong association between smoking and lung cancer. Smoking is not as strongly associated with cardiovascular disease or with bladder or pancreatic cancer, and one would expect the confounding effects of smoking to be even less for these diseases. The large numbers of men and women employed in various occupational categories in this study allowed for direct adjustment for age and thereby the ability to directly compare the confounding risk ratios not only for different occupational groups but also by duration of employment. It is noteworthy that, in our examination of smoking patterns by occupational group,

the confounding risk ratios ranged from 0.5 to 1.6. Moreover, smoking patterns confounded the estimate of lung cancer risk by 30% or more in only three of the 62 male occupations, namely, stationary engineers, printers, and fishermen, and only four of 18 female occupations, namely, food service workers, building managers and administrators, telephone and telegraph operators, and operatives. We also found confounding risk ratios of 0.8 or less for the clergy and chemical workers among men and for farmers and teachers among women, suggesting that for some occupational groups smoking patterns may also dilute the estimate of the risk ratio.

In a study of similar design, Asp [1984] characterized the smoking habits for 25 occupational groups in Finland. She reported confounding rate ratios ranging from 0.7 to 1.3 and observed only two occupational groups with confounding risk ratios of at least 1.3 and two groups with confounding risk ratios of 0.8 or less. Jappinen and Tola [1986] also found little confounding by smoking in a Finnish investigation of pulp and paper workers. When the smoking habits of the general Finnish male population was used as a reference, smoking habits of men employed in the paper mill produced the largest confounding risk ratio for lung cancer (RR = 1.6), while the smoking habits of men employed in the maintenance department produced the lowest risk ratio (RR = 0.8). In a study conducted in Montreal, Siemiatycki et al. [1988a] selected various stratifications for smoking and compared unadjusted odds ratios (OR) for lung cancer with smoking-adjusted OR using the Mantel-Haenszel method. Only 3 of 25 occupations produced confounding risk ratios outside the range of 0.8 to 1.3, when the smoking category that produced the largest discrepancy between the unadjusted and the adjusted OR was used. Finally, Blair et al. [1985], using U.S. data, compared standardized mortality ratios (SMRs) for lung cancer to smoking-adjusted SMRs for 29 occupations and also concluded that controlling for smoking had little impact on the risk estimate.

A major strength of the present investigation was the ability to examine smoking habits by duration of employment based on interview data. When cohort mortality studies report that the risk of lung cancer increases with the length of employment, questions arise as to whether this duration effect could be explained by the smoking habits of workers employed for longer periods of time. In order to address this problem, we compared the smoking habits of men by duration of employment in specific occupational groups to the smoking habits of the reference population, and estimated the risk ratio for lung cancer that would be expected owing to differences in smoking habits. Of the 38 occupational categories that we examined, we found only slight increases in the risk ratio based on the smoking habits of men who worked 20 or more years in a particular occupational category. The largest increase in the confounding risk ratio among long-term workers was only 1.3 and was observed for two occupations, painters and electricians. It is also of interest that we found little trend in confounding risk ratios with duration of employment. In another investigation, Siemiatycki and co-workers [1988b] classified workers based on level and duration of exposure to ten substances identified in the workplace and found little correlation between smoking habits and exposure levels or duration.

Several other factors need to be considered in interpreting these findings. First, the smoking data presented here reflect the smoking patterns of men and women employed during the late 1970s. In recent years, surveys have shown that the proportion of former smokers has increased in the United States, especially among white men [US DHHS, PHS, Centers for Disease Control, National Center for Health

Statistics, 1988], suggesting that other differences in smoking habits by occupation may emerge in the future. We also did not examine duration of smoking in various occupational groups, since there was little variation in this measure of smoking after controlling for age. Second, based on Axelson's method, the confounding risk ratios depend upon the numerical value chosen for the relative risks for smoking. We found, however, only marginal differences in the confounding risk ratios when relative risks obtained from the American Cancer Society's Prevention Study II were used in the equation (i.e., former smokers RR = 9, current smokers = 22) [U.S. DHHS, PHS, Office on Smoking and Health, 1989]. In addition, occupational titles in this analysis were grouped based on the size of the study population and may not correspond to the occupational titles used in other studies. It should also be noted that some of the occupational categories were quite broad, encompassing several specific occupational titles.

In summary, although the smoking habits of a small number of occupational groups resulted in a confounding risk ratio for lung cancer of 1.3 or greater, this analysis showed that the variation in smoking patterns among the occupational groups that we analyzed did not appreciably confound the estimates of relative risks of lung cancer. In addition, confounding by smoking had little impact on the estimates of relative risks of lung cancer among long-term workers and did not produce trends in risk ratios by duration of employment. This approach should not replace the collection of smoking data for a particular occupational cohort if it is feasible to do so. However, it appears that the risk estimates reported in occupational cohort mortality studies of lung cancer, which include occupations examined in this analysis, are not substantially biased by the lack of information on smoking.

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APPENDIXES

APPENDIX A. List of 62 Occupations Included in the Analysis of Smoking Patterns by Occupation Among White Men

Accountants, Lawyers, Judges, Librarians, Administrators, not elsewhere classified
Actors, Artists, Musicians
Airplane Pilots and Flight Attendants
Architects and Draftsmen
Auto Workers
Bank Officers and Finance Managers
Bank Tellers and Cashiers
Bill Collectors
Building Managers and Administrators
Butchers
Chemical Workers
Cleaners, Chambermaids, Housekeepers
Clergymen
Clerical Workers

APPENDIX A. List of 62 Occupations Included in the Analysis of Smoking Patterns by Occupation Among White Men (continued)

Construction Service Workers
Construction Workers
Cooks, Bakers, Food Counter Workers
Cranemen
Cutting Operatives
Drivers of Motor Vehicles (primarily truck drivers)
Dry Cleaning Operatives
Electricians
Engineers
Farmers and Laborers
Fishermen and Sailors
Food Service Workers
Former Members of the Armed Forces, Officers
Freight, Stock, Material Handlers
Garage Workers, Gas Station Attendants
Gardeners
Insurance Agents, Advertising Agents
Janitors, Garbage Collectors
Lumbermen and Woodworkers (primarily carpenters)
Manufacturing Workers, not elsewhere specified
Mechanics
Metal Fabrication Workers
Metal Machinery Workers
Miners
Newsboys
Nurses, Midwives, Dieticians
Operatives, miscellaneous and not otherwise specified
Ore Refinery and Foundry Workers
Painters
Plumbers and Pipefitters
Policemen, Detectives, Guards
Postmen
Printers
Private Household Workers
Radio Operators
Radio/TV Mechanics and Repairmen
Railroad Workers
Real Estate Agents
Recreation Workers
Salesmen and Sales Managers
Stationary Engineers and Power Station Operators
Stationary Firemen
Statisticians and Actuaries
Storekeepers and Stock Clerks
Tailors and Dressmakers

APPENDIX A. List of 62 Occupations Included in the Analysis of Smoking Patterns by Occupation Among White Men (continued)

Teachers, Economists, Mathematicians, Psychologists, Social Scientists
Textile Workers
Welders, Flame-cutters, Solderers

APPENDIX B. List of 18 Occupations Included in the Analysis of Smoking Patterns by Occupation Among White Women

Accountants, Lawyers, Judges, Librarians, Administrators, not elsewhere classified
Bank Tellers and Cashiers
Building Managers and Administrators
Cleaners, Chambermaids, Housekeepers
Clerical Workers
Cooks, Bakers, Food Counter Workers
Farmers and Laborers
Food Service Workers
Manufacturing Workers, not elsewhere specified
Metal Machinery Workers
Nurses, Midwives, Dieticians
Operatives, miscellaneous and not otherwise specified
Private Household Workers
Salesmen and Sales Managers
Storekeepers and Stock Clerks
Tailors and Dressmakers
Teachers, Economists, Mathematicians, Psychologists, Social Scientists
Telephone and Telegraph Operators

APPENDIX C. List of 37 Occupations Included in the Analysis of Occupation by Duration of Employment Among White Men

Accountants, Lawyers, Judges, Librarians, Administrators, not elsewhere classified
Auto Workers
Bank Tellers and Cashiers
Bill Collectors
Building Managers and Administrators
Clerical Workers
Construction Workers
Cooks, Bakers, Food Counter Workers
Cranemen
Drivers of Motor Vehicles
Electricians
Engineers
Farmers and Laborers
Fishermen and Sailors
Food Service Workers

APPENDIX C. List of 37 Occupations Included in the Analysis of Occupation by Duration of Employment Among White Men (continued)

Former Members of the Armed Forces, Officers
Freight, Stock, Material Handlers
Garage Workers, Gas Station Attendants
Gardeners
Insurance Agents, Advertising Agents
Janitors, Garbage Collectors
Lumbermen and Woodworkers
Manufacturing Workers, not elsewhere specified
Mechanics
Metal Fabrication Workers
Metal Machinery Workers
Miners
Newsboys
Operatives, miscellaneous and not otherwise specified
Painters
Policemen, Detectives, Guards
Postmen
Salesmen and Sales Managers
Storekeepers and Stock Clerks
Teachers, Economists, Mathematicians, Psychologists, Social Scientists
Textile Workers
Welders, Flame-cutters, Solderers